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COMPOSITE BODY OF ION EXCHANGE RESIN
[Ion koukan jushi fukugoutai]

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Specification

1. Name of this Invention

COMPOSITE BODY OF ION EXCHANGE RESIN

2. Claims

[1] Composite body of ion exchange resin comprising a production step of bonding an ion exchange resin, a water-soluble high-molecular compound and a water-swelling high-molecular compound in one body.

[2] Composite body of ion exchange resin according to the Claim 1, wherein said water-soluble high-molecular compound is polyvinyl alcohol, and said water-swelling high-molecular compound is a thermally processed or electronic-ray-bridged saponified substance of maleic acid monoester-vinyl acetate copolymer having 0.5 - 30 mol% content of maleic acid monoester and at least 70 mol% degree of saponification.

3. [Detailed Explanation of this Invention]

[Prior Art]

An ion-exchange resin is widely utilized in various fields as catalysts, medicines, insecticide, soil improvers, industrial chemicals, or the like. Said resin is usually used in a form of powder or particles. However, depending on the applications, the resin is used as a film, sheet, ribbon, rope, or block.

To relatively easily produce the resin of said forms, a composition comprising ion-exchange resin powder, water-soluble high molecule, and water is molded to films or sheets or made into

particle blocks. However, according to the experiments conducted by the developer of this invention, the products obtained in this manner drastically reduces the ion-exchange capacity in the ion-exchange resin, and therefore, are not effective for practical use.

[Method to Solve the Problems]

After investigating a solution for solving this problem, the developer of this invention discovered that, by mixing a composition comprising said ion-exchange resin, water-soluble high-molecular compound and a water-swelling high-molecular compound, any form of composition could be produced (e.g., film, sheet, ribbon, rope, or block) without affecting the ion-exchange capacity of the powered ion-exchange resin. That is, this invention provides a composite body of ion exchange resin comprising a production step of bonding an ion exchange resin, water-soluble high-molecular compound and a water-swelling high-molecular compound in one body.

The ion-exchange resin used in the present invention is not particularly limited to a certain material. Examples are negative, positive, or dipolar ion-exchange resins containing various ion-exchange groups (e.g., carboxyl group, sulfonic acid group, phenol hydroxide group, amino group, substituted amino group, or 4th class ammonium salt group).

In addition, the water-soluble high molecule may be any selected material.

A typical example is polyvinyl alcohol having 500 - 2,500 polymerization ratio and approx. 80 mol% or higher saponification degree.

Also, it may be a polyvinyl alcohol derivative. Examples are polyvinyl alcohol containing a carbonyl group and polyvinyl alcohol processed with formal, acetal, butylal, urethane, sulfonic acid, carboxylic acid, or the like. Furthermore, a saponified copolymer of vinyl ester, monomer copolymerizable with vinyl ester, and polyvinyl alcohol may be used. Examples of said monomer are olefins, such as ethylene, propylene, isobutylene, α -octene, α -dodecene, α -octadecene or the like; unsaturated acid or its mono or di alkyl, such as acrylic acid, methacrylic acid, crotonic acid, maleic acid, maleic acid anhydride, itaconic acid, or the like; salts; nitrile, such as acrylonitrile, methacrylonitrile, or the like; amide, such as acryl amide, methacryl amide, or the like; olefin sulfonic acid or its salt, such as ethylene sulfonic acid, aryl sulfonic acid, methacryl sulfonic acid, or the like; and materials, such as alkyl vinyl ether; vinyl ketone, N-vinyl pyrrolidone, vinyl chloride, vinylidene chloride, or the like. However, other materials may be used in addition to those examples.

Examples of water-soluble high molecule materials other than polyvinyl alcohol are cellulose derivatives, such as methyl cellulose, ethyl cellulose, hydroxyl methyl cellulose, hydroxyl propyl methyl cellulose, hydroxyl ethyl cellulose, carboxy methyl

cellulose, amino methyl hydroxyl propyl cellulose, amino ethyl hydroxyl propyl cellulose, or the like; starch, traganth, pectin, glue, alginic acid or its salt, gelatin, polyvinyl pyrrolidone, polyacrylic acid or its salt, polyacrylic amide, polymethacrylic amide, acetic acid vinyl and maleic acid, copolymer of unsaturated acid (e.g., maleic acid anhydride, acrylic acid, methacrylic acid, itaconic acid, fumalic acid, crotonic acid, or the like), copolymer of styrene and said unsaturated acid, copolymer (or salt or ester of copolymer salt) of vinyl ether and said unsaturated acid. Those materials may be used alone or mixed.

The water-swelling high-molecular compound is a resin that is not soluble but highly absorbs water and swells when put in water. Any known water-swelling high-molecular compound may be used. Examples are vinyl ester-unsaturated carboxylic acid (or its derivative) copolymer saponified materials. Examples are unsaturated mono carboxylic acid or its ester (e.g., acrylic acid, methacrylic acid, crotonic acid or the like), unsaturated dicarboxylic acid or partial/complete ester (e.g., salt, maleic acid, fumalic acid, itaconic acid, or the like), polyvinyl alcohol (or bridged material - heat-treated material, electronic or radiation ray treated material, or the like) denatured by salt or anhydride. The amount of unsaturated carboxylic acid (or its derivative) should be 0.5 - 30 mol%, preferably 1 - 10 mol%.

Examples of other high-molecules are polyethylene oxide, polyvinyl pyrrolidone, sulfone-processed polyethylene, starch-(metha) acrylonitrile copolymer saponified material, hydrolyzed polyacrylic amide, polyacrylic acid salt, starch-(metha) acrylic acid salt copolymer, ethylene-vinyl ester-unsaturated carboxylic acid (or its derivative) copolymer saponified material, hydroxyl alkyl acrylate - acryl amid copolymer saponified material, and bridged materials of said substances. However, applicable materials are not limited to those. Said examples may be used alone or mixed.

The mixing ratio of ion-exchange resin, water-soluble high molecule, and water-swelling high molecule should be: Ion-exchange resin : (water-soluble high molecule + water-swelling high molecule) by weight = 100 : 4 - 100 : 35, preferably 100 : 10 - 100 : 20. Also, water-soluble high molecule : water-swelling high molecule should be 150 : 1 - 7 : 5, preferably 7 : 1 - 7 : 3.

To produce a complex material, said three components and water are mixed. Water may be any amount as long as it can dissolve water-soluble high-molecules. However, normally, it is 5 - 20 wt%, preferably 7 - 15 wt% per the amount of water-soluble high molecules. The prepared composition is molded, granulated, or blocked using any conventional method. For example, to mold for forming films, sheets, ribbons, ropes, fibers, or the like, a flow-extension method, pressure extrusion method, or the like may be used. Molded material is dried at 30 - 50°C. The obtained complex material is made as one-

body by the binder effects of ion-exchange resin, water-swelling high molecule, and water-soluble high molecule, which can be effectively used to produce peat-moss substitutions (e.g., cultivation material for plants, plant transfer material, moisture retention material for potted plants, anti root-damage material, water-retention material, soil improver, freshness preservation agent for vegetables, fish, shell fish).

[Operational Examples]

The following explains operational examples of this invention. Note that "%" and "portions" in the examples designate the amount based on weights.

Operational example 1:

50 portions of weak acidity cationic exchange resin (Diaion SK-1B.H) and 50 portions of 14% polyvinyl alcohol (polymerization ratio = 1100, saponification degree = 97.5 mol%) aqueous solution were mixed. Then, 1 portion of maleic acid mono methyl - acetic acid vinyl copolymer saponified material (containing 4.5 mol of maleic acid; saponification = heat treated at 130 - 135°C for 170 - 180 min) was added. The mixture was processed with a flow-extension method to form a circular complex body (thickness = 5 mm; inner diameter = 50 mm).

After this complex body was put in 300 ml of 0.5% sodium chloride aqueous solution, the changes in the liquid pH were traced to examine the ion-exchange capacity. The pH measured at start time

was 5.8, which was 3.0 when measured 3 minutes later. The pH measured 5 minutes later was 2.5 and stabilized.

Comparison example 1:

The same experiment performed in the operational example 1 was conducted except that maleic acid mono methyl - acetic acid vinyl copolymer saponified material was not used. When pH was measured 5 minutes later, it did not decrease from 5.8. The pH was 3.0 when measured 3 hours later.

Operational example 2:

An aqueous solution (98% water) comprising 50 portions of Diaion SK-1B.H and 4 portions of polyvinyl alcohol (polymerization ratio = 500, saponification ratio = 87.5 mol%) was saponified to prepare the material described in the Operational example 1 and made as a complex body using the same method.

The pH measured at start time was 5.8, which was 2.8 when measured 3 minutes later. The pH measured 5 minutes later was 2.5 and stabilized.

Operational example 3:

50 portions of positive ion-exchange resin (Amberlite IR-120.H), 50 portions of polyvinyl alcohol (polymerization ratio = 1500, saponification ratio = 99.5 mol%) aqueous solution, and 3 portions of maleic acid mono methyl-acetic acid vinyl copolymer saponified material (maleic acid mono methyl content = 2.2 mol%, saponification degree = 94.5 mol% being irradiated by 5 M rad ray) were mixed and

tested by the same method as described in the Operational example 1.

The pH measured at start time was 5.8, which was 2.6 when measured 3 minutes later. The pH measured 4 minutes later was 2.5 and stabilized.